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Learning trajectories for developing generic skills in higher education: A review study on design choices and helping and hindering factors

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Abstract Students in higher education are supposed to develop various generic skills that are applicable across domains. To streamline the development of these skills, learning trajectories for skills are designed and implemented in educational programmes. The aim of this review study was to provide insight in design choices of these learning trajectories for skills (reason to start, goals, process, product, evaluation) and in helping and hindering factors for the development and implementation of these learning trajectories. The analysis of 13 articles showed that visualisation techniques, curriculum mapping, and curriculum sequencing are frequently used to present the curriculum of the educational programme with the learning trajectories for generic skills. Although different educational programmes often provide comparable reasons to develop a skills learning trajectory and aim to achieve comparable goals, the design of skills learning trajectories appears to differ a lot between programmes. Various factors appear to help or hinder a successful implementation of learning trajectories, but especially the engagement of educational staff and their workload play an important role. The study findings will be illustrated by concrete cases of learning trajectories for generic skills. Moreover, the scientific and practical implications of the study for developing such learning trajectories will be discussed.

Keywords Generic skills, higher education, learning trajectories, review study, skills education

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1 Introduction

Due to changes in society and the labour market, like the ever increasing role of complex tasks and digitalisation, job requirements are changing as well. The current labour market asks for people who do not only have domain-specific knowledge and skills. In addition, they should also have more generic skills that are applicable across academic content domains (like languages, physics, and economics) and professional domains (like health care, business administration, and engineering) (Dutch Ministry of Education, Culture, and Science, 2019). In other words, education should prepare students to develop a broader generic skills repertoire, including cognitive (such as academic writing and presenting), interpersonal (like collaboration), and metacognitive skills (e.g., self-regulation) (Goos, 2018; Ministry of Education, 2019; OESO, 2018). This holds for all educational levels but certainly for higher education, which is the context of the present study.

Until now, higher education programmes have been mostly content-focused, stressing domain-specific knowledge and skills, and the design of their curricula is mainly modular in nature (Malecka et al., 2021). The increased focus on the development of students' generic skills requires higher education programmes to redesign their curricula and implement learning trajectories for generic skills across courses.

Like in many universities worldwide, this trend is illustrated by educational programme innovations at the university of the authors of this manuscript, a university in the domain of life sciences in the Netherlands. All BSc programmes in different domains such as biology, consumer studies, plant sciences, and food technology have been requested to design and implement specific learning trajectories for generic academic skills such as writing, presenting, and collaborating (a selection needs to be made from 16 skills). The question is, however, what design choices should and could be made in this regard and why, and how the design and implementation process could be organised.

This illustration touches upon the rationale behind the present review study. The aim of the study was to provide insight in design choices of existing learning trajectories for generic skills and in helping and hindering factors for the development and implementation of these learning trajectories. In this way, our study aims to support the educational programmes at our own and other universities in the informed design of skills learning trajectories as well.

2 Theoretical background

The focus of the present review study was explicitly on learning trajectories for generic skills as opposed to content-related learning trajectories in general. The

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focus on a specific generic skill in a particular learning trajectory embedded in an educational programme as opposed to the alignment of domain-specific content (e.g., mathematics) across courses (Biemans et al., 2019; 2020) has consequences for the design and implementation of the learning trajectories, which makes the two categories of learning trajectories incomparable (see also Harris & Rainey, 2012). Most teachers in higher education feel more responsible for the domain-specific content of their educational programme than for students' generic skills development, which makes the design of generic skills learning trajectories more challenging. Moreover, generic skills are more difficult to assess (there are for example often no correct or false answers), and require a longer time span and repetitive attention for their development to occur. Finally, students differ to a higher extent in their levels of generic skills and they are increasingly asked to demonstrate their distinctive generic skills for the labour market, which has consequences for the design of skills learning trajectories *(Jorre de St Jorre, Boud, & Johnson, 2021).* While both types of learning trajectories have not received much attention in literature, this review study focusses on creating an overview of the design choices higher education programmes make in designing and implementing generic skills learning trajectories.

The present study aims to shed light on the following design choices of existing learning trajectories for generic skills in higher education curricula: reason to start, goals, (development) process, product, and evaluation of the learning trajectories. These design choices reflect the process of design and implementation of these learning pathways (see also Biemans et al., 2024). At the beginning, the reasons for developing these learning trajectories are made explicit. As a next step, the particular goals of the learning pathways are defined. After that, the actual development process of the skills learning trajectory takes place and the learning pathway finds its product shape in terms of educational design. As a last step, evaluation of the skills learning trajectory can take place. Depending on the reason to start, the educational vision, the intended goals or outcomes of the learning trajectories as well as the local context, programmes are likely to make different design choices. As there is no standard way of designing learning trajectories, this study intends to shed light on the design choices different reported programmes make in designing and implementing their skills learning trajectories (Baartman, Van Schilt-Mol, & Van der Vleuten, 2022). Up until now, an overview of empirical research on the variety in educational design choices of existing learning trajectories for generic skills is lacking. The same holds for the helping and hindering factors for the development and implementation of these learning trajectories.

The focus on trajectories – instead of isolated courses or trainings - is based on the knowledge that skills development is an ongoing process, which takes place during the whole study programme of the students and even after

graduation. Various factors may influence this process of skills development, which has consequences for the design of generic skills learning trajectories. To streamline the development of generic skills, it is crucial that students learn about, practice, and receive feedback on the use of these skills multiple times and reflect on their learning (Malecka & Boud, 2021; Van der Vleuten & Schuwirth, 2005). But even if students have the chance to repeatedly work on their skills, this does not necessarily lead to increased skills development. Merrill (2002) stated that, for skills that are taught in a dispersed way, students should be stimulated to build on previous learning experiences in order for skills development to take place. Moreover, a recent educational design study of Clement and colleagues (2023) shows that when generic skills are not explicitly addressed and reflected upon, students will focus on domain-specific content at the expense of generic skills development. In other words, the connection with previous learning should be made explicit, just as reflection on skills development, otherwise skills development might be insufficient (see also Lilleväli & Täks, 2017).

It is therefore essential that different courses in which a similar skill is addressed strive towards the same pre-determined learning goals for that particular skill, and that these courses are aligned to each other in the implementation of learning activities to develop the skill. Only when courses support overall learning goals related to skills development, and gradually strengthen students' skills, students have the possibility to reflect on their skills development (Wijngaards-de Meij & Merx, 2018). Furthermore, it is important that consecutive assessments of skills development are related to the learning goals, and that assessments are in line with each other, so that students can then relate their current performance to their previous performance (Malecka & Boud, 2021). Only if there is coherence between learning goals, learning activities, and assessments, continuous skills development can take place (Levander & Mikkola, 2009). This coherence is what Biggs and Tang (2015) refer to as 'constructive alignment'. Educational programmes should – both at the course and the programme level – first determine learning goals, then make sure that corresponding learning activities address these learning goals, and finally assess whether students acquired the learning goals in relation to the desired skills.

Different scholars (Wijngaards-de Meij & Merx, 2018) define learning trajectories in various and slightly different ways. Incorporating these different definitions, the present study describes a (generic) skills learning trajectory as: A coherent and meaningful combination of generic skill-related content and corresponding teaching and learning activities implemented in different courses throughout the curriculum – which are aligned to and build upon each other – and enabling students to acquire pre-determined learning goals related to development of the particular skill.

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Designing and implementing these skills learning trajectories can be considered as an extensive process that involves multiple phases and in which various stakeholders work together (see e.g. Barrett et al., 2003; Mälkki et al., 2015; Wijngaards-de Meij & Merx, 2018). As required skills, skills levels, or intentions of higher education programmes for skills learning trajectories are likely to differ extensively, the design and implementation will be context-specific (Baartman et al., 2022). For example, programmes may opt for integrating all skills-related education in existing content courses (as reported by Haas et al. (2012) for example), or they may design one or more separate courses completely devoted to the development of that particular skill (see for instance Wijngaards-de Meij & Merx, 2018). The different steps in designing a learning trajectory do not stand alone, but may be interrelated to each other: Educational programmes that have different goals in mind when designing the skills learning trajectory may also go through different processes and/or make different choices for the design of the trajectory.

Education programmes are also likely to face various challenges in this design and implementation process (Wijngaards-de Meij & Merx, 2018). The implementation of skills education may, for example, be at odds with the programme-specific content. "Graduates' working life" requires both up-to-date domain-specific knowledge and skills as well as generic skills (Ministry of Education, Culture, and Science, 2019), and most teachers feel more responsible for and equipped to focus on the domain-specific knowledge and skills. Indeed, balancing domain-specific content and generic skills education seems to be a main difficulty that programmes face (Barrett et al., 2003). Moreover, factors such as inadequate communication between teachers of different courses, or changes in teaching staff can also challenge the design and implementation of new generic skills learning trajectories (O'Neill et al., 2014).

As the current academic literature mostly reports on skills learning trajectory case studies, the aim of this review study is twofold. First, it aims to *provide an overview of the design and implementation choices programmes make in their skills learning trajectory development. This allows other programmes to consider the design and implementation choices they can make and how these relate to each other.* Second, this review study also aims to illuminate the helping and hindering factors in designing and implementing these skills learning trajectories. Both the design and implementation choices and the helping and hindering factors will be illustrated with two concrete examples from the literature to make the findings less abstract.

The following research questions were formulated for this review study:

1 What is the variety in design and implementation choices of learning trajectories for generic skills in curricula of higher education programmes related to:

a. Reason to start the development of the learning trajectories;

b. Goals of the learning trajectories;
c. Process: development process of the learning trajectories;
d. Product: shape of the resulting learning trajectories;
e. Evaluation of the learning trajectories.
f. What factors may help or hinder the design and implementation of these learning trajectories?

3 Method

Inclusion and exclusion criteria
In order to select relevant articles from the scientific literature, the following inclusion criteria were formulated: Articles should 1) provide a description of one or more learning trajectories for 2) generic skills in 3) higher education. To keep the scope as broad as possible, articles on all kinds of educational programmes regardless of domain, educational levels (bachelor or master), and generic skills were included. Finally, only articles published between 2000 and 2020 were included, to ensure that the information was still relevant to current practices in higher education.

Articles were excluded if 1) the focus was on personal (flexible) learning pathways chosen by individual students, 2) they described a single course rather than the curriculum of the educational programme as a whole, or 3) described learning trajectories at another educational level, such as primary or secondary education, and 4) they were not published in English.

Search strategy
Three databases for academic literature were searched: Scopus, Web of Science, and ERIC. Search terms related to skills, learning trajectories, curriculum, and higher education were used. As initial searches yielded limited results, it was decided to broaden the only original search term skill* to skill* OR competenc* OR learning OR knowledge. These were combined with AND learning trajector* OR learning path* AND curriculum AND university OR “higher education” OR undergraduate. The search was limited to English articles that were published in peer-reviewed scientific journals between 2000 and 2020. After having selected the relevant articles resulting from the search, the ‘snowballing’ technique was used: reference lists of the selected studies were used to find additional relevant articles that met the criteria mentioned in the previous paragraph and could be included in the review study.

Selection of relevant articles
The search yielded 55 scientific papers in Scopus, 32 in Web of Science, and 34 in Eric. After exclusion of articles that appeared double in the search, 82

unique papers remained. The first author read all the abstracts to check whether articles fitted the scope of the study. If the abstract did not provide enough information, the complete article was read. In case of doubt about inclusion, the authors decided together. Many papers were not relevant: they did not focus on learning trajectories (*n* = 39) and/or described personal study pathways (*n* = 21), did not focus on higher education (*n* = 18), described only a single course (*n* = 1), or a computer programme (*n* = 1). Three articles could not be included because no access to them could be acquired despite contacting the authors of these articles. Finally, seven papers from the search were included in the review. The snowballing technique was then used to determine additional relevant papers. The resulting six papers did not appear in the search results because they were published in journals or conference proceedings that could not be traced by the search engines that were used. The final sample contained 13 papers (see Table 1).

Analysis

The 13 papers included in this study described how the curricula of particular educational programmes at specific higher education institutes had changed or were about to change because of the design and implementation of learning trajectories for generic skills. Most articles described how skills learning trajectories were implemented in one specific educational programme, or how this was done in multiple programmes. The remaining articles concentrated on the university as a whole or on hypothetical programmes. The articles focused on a great variety of educational programmes (see Table 2).

Table 1

Articles found through the search and snowballing technique

Search	Snowballing round
Leoniek Wijngaards-de Meij & Sigrid Merx (2018) Improving curriculum alignment and achieving learning goals by making the curriculum visible, *International Journal for Academic Development, 23*(3), 219-231, DOI: 10.1080/1360144X.2018.1462187	O'Neill, G., Donnelly, R., & Fitzmaurice, M. (2014). Supporting programme teams to develop sequencing in higher education curricula. *International Journal for Academic Development, 19*(4), 268–280. doi:10.1080/136014 4X.2013.867266
Whillier, S., Spence, N., & Giuriato, R. (2019). A collaborative process for a program redesign for education in evidence-based health care. *Journal of Chiropractic Education, 33*(1), 40-48.	Haas M, Leo M, Peterson D, LeFebvre R, Vavrek D. (2012). Evaluation of the effects of an evidence-based practice curriculum on knowledge, attitudes, and self-assessed skills and behaviors in chiropractic students. *J Manipulative Physiol Ther. 35*, 701–709
Caskurlu, S., & Ashby, I. (2018). An integrated competency acquisition progress tracking system in competency-based higher education. *International Journal of Learning Technology, 13*(4), 352-368	Ashby, I., Caskuly, S., & Exter, M., (2018). Evolving roles of faclty at an emerging hybrid competency-based transdisciplinary program. *The Journal of Competency-Based Education, 3,* doi: https://doi.org/10.1002/cbe2.1059
Marcus, J., Coops, N. C., Ellis, S., & Robinson, J. (2015). Embedding sustainability learning pathways across the University. *Current Opinion in Environmental Sustainability, 16*,7–13	*Lasater, K., Salanti, S, Fleishman, S., Coletto, J., Hong, J., & Viejo, A. (2009). Learning activities to enhance research literacy in a CAM college curriculum. Alternative Therapies in Health and Medicine, 15(4), 46-54.*
Martí, C., Feliu, J., & Varga, D. (2014). Geographic information technology and innovative teaching: Keys to geography degree curriculum reform. *Journal of Geography, 113*(3), 118-128.	
King, S., Hall, M., McFarlane, L. A., Paslawski, T., Sommerfeldt, S., Hatch, T., ... & Norton, B. (2017). Launching first-year health sciences students into collaborative practice: Highlighting institutional enablers and barriers to success. *Journal of interprofessional care, 31*(3), 386-393.	Barrett, G., Greenwood, R., & Ross, K. (2003). Integrating interprofessional education into 10 health and social care programmes. *Journal of Interprofessional Care, 17,* 293–301. doi:10.1080/ 1356182031000122915
Mälkki, H., Alanne, K., & Hirsto, L. (2015). A method to quantify the integration of renewable energy and sustainability in energy degree programmes: a Finnish case study. *Journal of Cleaner Production, 106*, 239-246.	Auvinen, T., (2011). *Curriculum development using graphs of learning outcomes.* In: Dritsos, S.E. (Ed.), Full Paper Proceedings of the 1st EUCEET Association Conference, New Trends and Challenges in Civil Engineering Education, Patras, Greece, 24-25 November, pp. 27-36.

Table 2

Overview of (under)graduate programmes in the included articles

	Programme	Undergraduate/graduate
Wijngaards-de Meij & Merx, 2018	Media & Culture	Undergraduate
	Psychology	Undergraduate
	Veterinary studies	Undergraduate
	Pharmaceutical studies	Graduate
Whillier et al., 2019	Chiropractic program	Undergraduate + graduate
Haas et al., 2012	Chiropractic program	Graduate
Ashby et al., 2018	Transdisciplinary studies in technology	Undergraduate
Marcus et al., 2015	No specific programme	
Martí et al., 2014	Geography, land-use planning, and environmental management	Graduate
Barrett et al., 2003	10 professional awards: four nursing pathways, midwifery, social work, diagnostic imaging, radiotherapy, physiotherapy and occupational therapy.	Graduate
Mälkki et al., 2014	Four majors in an energy degree programme: 1. Energy and Environmental Technology (EET) 2. Heat and Ventilation Technology (HVAC) 3. Urban Energy Systems and Energy Economics (UESEE) 4. Combustion Engine Technology (CET)	Graduate
Auvinen, 2011	Structural Engineering and Building Technology	Not specified
O'Neill et al., 2014	Engineering, chemistry, international tourism, and business	Undergraduate + graduate
Caskurlu, & Ashby, 2018	No specific programme	
Lasater et al., 2009	College of Oriental Medicine (OCOM) in collaboration with the University School of Nursing	Graduate
King et al., 2017	Health sciences	Undergraduate

The first author read each paper and selected meaningful fragments: Pieces of text directly taken from the respective article (1) that described the reason to develop the skills learning trajectory (reason to start), the goals of the trajectory

(goals), the development process of the trajectory (process), the shape of the trajectory (product), or how the learning trajectory was evaluated (evaluation), or (2) that described (possible) factors helping or hindering the design and implementation of the learning trajectory. Usually, fragments were one to five sentences long. Multiple fragments were selected from each article if considered relevant. To answer the first research question, each of these meaningful fragments (n = 176) under (1) was then coded based on five overarching codes. These codes were formulated in consultation with the other authors of this manuscript in a deductive manner. The codes covered the design and implementation choice aspects of the first research question. The code '*reason to start*' was used for fragments that described why an institute or educational programme decided to develop a particular generic skills learning trajectory. '*Goals'* was used to categorize fragments describing what the intended learning outcomes of the particular trajectory were, what students should be able to do, or what generic skills they should have acquired after graduation. Fragments categorized as '*process'* described the actions that were taken in developing the particular learning trajectory. '*Product'* related to the shape of the actual learning trajectory: the kind of instruction that students received, the learning materials that were used, or what kind of teaching roles were associated with the learning trajectory. Finally, '*Evaluation'* was used for fragments that described how learning trajectories were (to be) evaluated, or what stakeholders' experiences were with the trajectory. Only one code was assigned to each fragment. Table 3 provides an example of a meaningful fragment for each code. Subsequently, based on the information in the meaningful fragments that were grouped under one of the five determined codes, sub-codes were inductively assigned to each fragment depending on the content. In this way, it was possible to describe the different aspects of the five overarching codes in more detail.

In order to answer research question 2, all meaningful fragments *(n* = 63) that described (possible) factors helping or hindering the design and implementation of the learning trajectory were grouped into categories based on the content of the fragments. This was done inductively, because factors could be helping or hindering at the same time, depending on what was described. Four themes emerged from this grouping activity: *programme, staff, students,* and *tools & preconditions. 'Programme'* related to factors that had to do with the design of the programme, like finding the right balance between programme content and skills content. '*Staff*' was used for fragments that described factors related to the role of the staff in the learning trajectories. A comparable code was used for '*students'.* Finally, '*tools & preconditions'* related to preconditions, such as logistic issues, that helped or hindered the learning trajectories. A fragment could receive only one code. See Table 3 for an example of every code.

Table 3

Examples of meaningful fragments for the codes 'Reason to Start', 'Goals', 'Process', 'Product', and 'Evaluation'

Code	Meaningful fragment
Design choices of the learning trajectory	
Reason to start	"In 2015–2016, the 5-year chiropractic program […] was redesigned to increase the evidence-based focus of health education from the 1st to the final year of study, at the instigation of the head of department (3rd author)." (Whillier et al., 2019)
Goals	"Students should become proficient in the history and underlying ideas and principles of sustainability, the incorporation of ideas related to natural capital and resources, social justice, resilience, adaptability, and complexity." (UBC, 2013)
Process	"The process began with mapping the existing curriculum. […] All existing courses and their assessments were mapped to the 3 streams in the first 2 workshops." (Whillier et al., 2019)
Product	""There are three interprofessional modules in the curriculum, one in each year of study as most programmes are for 3 years. The first interprofessional module begins during the first 6 weeks of the student programme. The second and third modules are scheduled at the beginning and middle of years 2 and 3 respectively." (Barrett et al., 2003)
Evaluation	"A prospective cohort design was used to evaluate the effectiveness of the new EBP curriculum." (Haas et al., 2012)
Factors helping or hindering the learning trajectory	
Programme	"However, this philosophy can be difficult to maintain as curriculum changes, contextual influences shift (Stark, 2000), and academic staff change." (O'Neill et al., 2014)
Staff	"The success of the process is vitally dependent on the cooperative presence of the entire department, to provide the details of the courses they teach but also to discuss the flow of information within streams from year to year." (Whillier et al., 2019)
Students	"However, making learning trajectories visible in itself is not enough to improve this awareness; the student has to be actively engaged in reflecting on the learning trajectory in relation to their own learning process." (Wijngaards-de Meij & Merx, 2018)
Tools & preconditions	"Staff communication regarding programme sequencing was dependent on very pragmatic issues, such as space to meet […]" (O'Neill et al., 2014)

4 Results

Research question 1: Design choices of skills learning trajectories

Most articles contained all five codes, but some articles lacked information to

determine their reason to start or goals, or did not describe how the learning trajectory was (intended to be) evaluated. The most common reasons to start, goals, development processes, product shapes, and ways to evaluate the skills learning trajectory are discussed below.

To investigate why learning trajectories were developed, all meaningful fragments that received the code *Reason to start* were examined. Different reasons to develop and implement skills learning trajectories were found in the literature. Most articles mentioned one reason, but three articles (Mälkki et al., 2015; Whillier et al., 2019; Wijngaards-de Meij & Merx, 2018) mentioned multiple reasons. The most common reason to develop learning trajectories was to adhere to a specific educational vision or strategy. Whillier et al. (2019), for example, mentioned the implementation of evidence-based practice in a chiropractic programme. Three different learning trajectories (a clinical research stream, a clinical science stream, and a professional practice stream) should make sure students are systematically educated on all aspects of evidence-based practice. The next common reason to start was to solve curriculum misalignment or to ensure curriculum alignment. In these cases, learning trajectories were implemented to transform the curriculum being built up by individual separate courses to one in which courses were connected and aligned to each other. Finally, a relatively common reason to start was to 'prepare students for the future'. 'The future' could refer to students' future work environment or professions, or to life in general.

Next, fragments coded with *Goals* were investigated to examine what learning outcomes the educational programmes aimed for with the learning trajectories. Inductive coding led to four different goals. The most common goal was to improve students' generic skills in a certain domain, ranging from literacy skills to collaboration skills and to management skills. Other goals were to improve the research skills content in the programme and to identify and manage learning goals.

All fragments coded with *Process* were examined to explore what actions programmes undertook to develop the learning trajectories. In total, 22 codes were determined inductively. The fact that many different activities were identified, showed that the process of designing learning trajectories can take a variety of forms. The most common processes are discussed below.

The development process of designing learning trajectories almost always included making some kind of overview of the existing or desired curriculum. The minimum was simply making a visual overview. More advanced activities included curriculum mapping (mapping course content to the outcomes of the learning trajectory) and curriculum sequencing (determining the order of the courses so that they form an aligned curriculum). Three articles mentioned curriculum development without specifying what that entailed. The help of external experts could be called for in the development process. The background of these external experts varied greatly, depending on the content of the learning

trajectory and the kind of help that was needed. The formation of a special team was also a possible step in designing the learning trajectory. This team most often consisted of people that were involved in the educational programme in which the skills learning trajectory had to be implemented, sometimes next to other people such as external experts and/or programme directors. Other ways to involve teaching staff in the process included organising workshops in which staff did hands-on activities to design the learning trajectory (Barrett et al., 2003; Whillier et al., 2019), training staff to work with the learning trajectory (King et al., 2017), or communicating the curriculum sequencing to staff and students (O'Neill et al., 2014).

The product shape of the learning trajectories was examined by investigating all fragments that were categorized as *Product,* which led to 23 inductive codes. The actual (implemented) learning trajectory (the 'product') as described in the included articles, differed greatly between programmes. Two ways to introduce the learning trajectory early in the educational programme were described: by mentioning it at the start of the programme (within the first weeks or months), or by implementing an introductory course completely devoted to the (content of) the learning trajectory in the first year of the programme. Further integration of the learning trajectory in the curriculum took different forms. Some educational programmes described integrating the content of the skills learning trajectory in domain-content courses of the programme. Programmes could also use 'building blocks' of courses: Courses that together built up the learning trajectory, and were recognizable as such for students and staff. The courses could either be newly introduced, or based on existing courses. Assessment of skills was not always mentioned explicitly, but seemed to be done in different ways, through formative as well as summative ways of assessment. Only one article mentioned official rewarding of skills acquirement by using badges. Five reviewed articles mentioned a change in teacher roles in the implementation of the learning trajectory. Therefore, these new roles were included as an outcome of the decisions that were made during the process phase. An expert teacher – somebody working in a profession related to the content of the learning trajectory, for example – could now be responsible for teaching the content of the learning trajectory. Teachers' roles could change to being a mentor, having to coach students throughout their trajectory. Finally, clusters of teachers could be responsible for clusters of courses that were part of the learning trajectory.

Finally, it was examined how programmes evaluated and experienced the learning trajectory by inspecting all fragments coded under *Evaluation.* Many studies only described how they were planning to evaluate whether their initial goals had been reached, or were still in the process of evaluating their goals. Therefore, the focus was on *how* goals were (intended to be) evaluated. Goal evaluations almost always included multiple instruments. Most articles described evaluating the goals of the learning trajectory by investigating

staff's and students' experiences with the trajectory. For investigating staff's experiences, mostly interactive methods were used, such as interviews (Ashby et al., 2018), or group discussions (Whillier et al., 2019). For students' experiences, mostly questionnaires were used, either qualitative ones in which students were asked about their experiences (Whillier et al., 2019; Wijngaards-de Meij & Merx, 2018), or quantitative questionnaires in which they were asked to rate their skill level (Haas et al., 2012; Martí et al., 2014). Other sources used to evaluate the goal of the learning trajectory were students' assessment scores, and course evaluations to investigate students' experiences with learning activities and materials in the trajectory (Barrett et al., 2003; Whillier et al., 2019).

Research question 2: Helping and hindering factors

To get insight in the helping and hindering factors for skills learning trajectories design or implementation, 63 meaningful fragments were examined that mentioned aspects relating to helping or hindering factors. These fragments were divided into four categories: Factors related to the programme (n = 22), to staff (n = 18), to students (n = 14), and tools and preconditions (n = 9). Table 4 provides an overview of the helping factors per category (hindering factors are the opposite). The most frequently mentioned ones are discussed below.

Table 4

Overview of helping factors that contribute to successful development and implementation of Skills Learning Trajectories (SLTs)

Code	Sub-code	n
Programme	Philosophy	4
	Curriculum mapping	4
	Balancing LT and programme content	7
	Goal evaluation	1
	Sustainability when changes appear	3
	Timely assessment & feedback	1
Staff	Openness to change	1
	Workload and engagement	13
	Active broker	2
Students	Transparency of the LT	8
	Engagement	6
Tools and Precondi-tions	Availability	6
	Staff support and expert consultation	4
	Programme and board support	1

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Programme. The most important factor related to educational programme seems to be whether the balance between the content of the skills learning trajectory and the domain-specific content of the educational programme is right. If these two factors are unbalanced, it rather hinders than helps the development and implementation of the learning trajectory.

Staff. Learning trajectories benefit from the extent to which staff can manage the workload related to the learning trajectory. Staff may fear that designing and implementing learning trajectories increases their workload, as may indeed be the case. This may prevent them from successfully implementing the trajectories, or from executing them as originally intended.

Students. Once students are aware of the existence and design of the learning trajectory, and actively engage with it, the chance of success is higher. It is thus essential that the design of the learning trajectory is well communicated and explicated to students.

Tools and preconditions. Various tools and preconditions play a role in the design and implementation of learning trajectories, but the most important one seems to be availability: Staff needs to be available (both in number and in time) to design and implement the learning trajectory. Availability also refers to logistic challenges, such as whether space is available for staff to meet and discuss the learning trajectory. If availability of one particular kind is insufficient, this may hinder designing and implementing the trajectory.

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Two specific cases of different generic skills learning trajectories analysed as examples

To illustrate the findings of the review study, in this section, two specific cases reported in two of the reviewed articles will be presented to show the different design decisions (with respect to reason to start, goals, process, product, evaluation) being made and in helping and hindering factors. These two specific cases of generic skills learning trajectories were selected because they differed to a high extent in design and implementation choices that were made, despite aiming for a similar goal (curriculum alignment of skills education). In this way, possible variety in design and implementation choices could be shown.

Case 1: Wijngaards-de Meij & Merx (2018)
Study programme: Utrecht University, the Netherlands, 3 undergraduate programmes and 1 graduate programme.
Reason to start: Students were insufficiently aware of what skills they were learning during their studies, and as a consequence teachers had the experience that students had an apparent lack of these skills. Moreover, teachers were

unaware of when certain skills were taught in the curriculum. Consequently, curriculum alignment was not secured, with a risk of curriculum misalignment.
Goals: The first goal was to ensure curriculum alignment with respect to skills. The second goal was to make teachers and students aware of when skills were taught in the curriculum. Ultimately, this would help students develop skills that were taught in a dispersed way in the curriculum, because teachers would better be able to connect previously taught skills to their teaching content, and students would better be able to re-activate prior knowledge and reflect on it.
Process: One of the four programmes reorganized the study programme, thereby implementing a complete learning line for research skills. The other three programmes updated their already existing learning lines for research skills, professional skills, and analytical skills, respectively. The changes were supported by the Utrecht University Centre for Teaching and Learning. All programmes made use of action research: In a plan-act-reflect cycle, problems in the curriculum were identified, solutions were tested, and reflection served to identify possible new problems that needed a solution. The programmes made use of a newly designed curriculum mapping tool, that served to create a curriculum map, and visualised the relationship between different courses in the curriculum. By visualising the curriculum, it became clear which part of the skill was taught and/or practiced in which course. It also facilitated discussion between instructors of different courses to identify learning outcomes of the learning trajectory and discuss these.
Product: One programme designed a learning trajectory for research skills that made use of building blocks of core courses, making a team of instructors responsible for its content. The trajectory was integrated into different courses, and skills were thus taught in a dispersed way. The other three programmes updated their already existing learning trajectories. The most important change was that they all implemented the curriculum mapping tool in the programme, to make the learning trajectories (and thus the skill teaching content and assessment) visible for teachers and students at any moment. Furthermore, one programme decided to explicitly introduce the learning trajectory to students within the first two months of their studies. Another programme explicated the learning trajectory to students via skills assignments that were integrated in the curriculum mapping tool. The idea was that by forcing students to use the mapping tool, they would be repeatedly reminded of the learning trajectory.
Evaluation: Reflection on the process by members included in the process of learning trajectory design; focus groups with staff; questionnaire for students.
Helping and hindering factors: Several factors proved helpful to implement and/or update a learning trajectory. Staff members sometimes had the feeling the use of a curriculum mapping tool was forced on them. To get staff – including educational managers – engaged, it appeared to be helpful to provide information about the new way of working, for example in meetings

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and via a website. Staff also had concerns about the work load that updating the learning trajectory would take. Appointing a student-assistant to help with this diminished this workload. Furthermore, staff noticed that changes in staff and/or policy could lead to changes in the learning trajectory. To prevent that these changes would lead to misalignment, regular discussion of possible changes in the learning trajectory is necessary. This is also the case for updating information about content of the learning trajectory: Information needs to be checked at least yearly to keep it up-to-date. Appointing a coordinator to each learning trajectory who keeps information up-to-date and coordinates discussions between staff members would ensure this. Such a coordinator could also update the curriculum mapping tool, if implemented. Students noticed that although a curriculum mapping tool helped them to become aware of the learning trajectory, and to relate previously acquired skills to new knowledge and skills, it would be more practical if the tool was integrated in the already existing online environment.

Case 2: Whillier et al. (2019)
Study programme: Macquarie University, Australia, Chiropractic Department: 3 years of bachelor degree, 2 years of master degree
Reason to start: At national level, the Institute of Medicine Committee of Australia stated that all health care professionals should practice evidence-based medicine. At Macquarie University, it was noted that in chiropractic education, evidence-based practice was not sufficiently incorporated, and students lacked critical research skills, and skills to work in a practice-based and patient-centred manner.
Goals: At programme level, the aim was that these skills would be aligned across the curriculum.
Process: For the redesign of the programme, a development team was appointed, but department members were included in the process through workshops in which they were engaged in curriculum mapping and determining learning outcomes. Furthermore, non-staff members were included, too: the workshops were attended by a clinical supervisor and a recent graduate of the programme. The outcomes of these workshops served as input to the development team. A curriculum map was created to determine which skills were taught and assessed when within the programme, and by constructively aligning learning objectives, learning content, and assessments within different courses, a coherent programme was created.
Product: Three learning trajectories were developed: a clinical research trajectory, a clinical science trajectory, and a professional practice trajectory. The teaching content and assessment related to the skills that were to be learned were integrated in the content courses of the study programme, such that three integrated learning trajectories were developed.

Evaluation: Reflection-on-action by the design team was ongoingly conducted during the process: Progress was monitored and adjustments to activities were made if needed. In the future, they intended to use quantitative and qualitative evaluation methods, including questionnaires and group discussions with staff and students, to assess whether goals have been achieved. Monitoring effectiveness of learning trajectories through course evaluations and employer surveys.

Helping and Hindering factors: What helped the creation of the learning trajectories was that there was university support for the changes. For the creation of learning trajectories to be successful, it appeared vital that all staff members were included and informed about the changes, and that staff members were cooperating with the desired changes as well. Otherwise, the risk was that the implementation would fail. Once implemented, the success of the learning trajectory depended on ongoing monitoring and regular collaboration between staff members to make sure changes in staff and courses would not lead to changes in the learning trajectory.

5 Discussion

In this review study, 13 case studies on learning trajectories for generic skills in higher education were analysed. First, the study aimed to describe design and implementation choices (with respect to reason to start, goals, (development) process, product, evaluation) educational programme make in their learning trajectories for generic skills. The second goal was to provide an overview of helping and hindering factors for the design and implementation of these learning trajectories.

Educational programmes' reasons to start and their goals for the skills learning trajectories did not differ greatly – obviously, most cases focused on improving students' generic skills (e.g., Mälkki et al., 2015; Whillier et al., 2019; Wijngaards-de Meij & Merx, 2018) – but programme teams went through a great variety of development processes to design the learning trajectories, and the trajectories were shaped in very different ways. Nevertheless, two common activities in the development process phase stood out. The first activity was that almost all cases reported on visualising the current and/or desired curriculum in some way, often in combination with mapping desired learning outcomes of the skills learning trajectory to general course content (curriculum mapping) (e.g., Whillier et al., 2019), and/or determining the optimal order of the courses (curriculum sequencing) (e.g., Barrett et al., 2003; O'Neill et al., 2014). Having a "backbone of learning outcomes" is one of the principles of programmatic assessment: So, to be able to monitor the longer-term development of learning outcomes, this backbone of learning outcomes (to which all activities are connected) is necessary

(Heeneman et al., 2021). In addition, designing "consecutive tasks" (successive tasks, in which feedback can be used) is crucial for longer-term development of skills as well (Malecka, Boud & Carless, 2021). Finally, visualisation of skills learning lines has been identified as success factor for the design and implementation of skills learning trajectories (Baartman & Gulikers, 2022). Second, experts who were knowledgeable about (the content of) skills learning trajectories were asked to assist in the design and implementation of the trajectories to assure alignment and coherence (e.g., King et al., 2017). Thus, these two design decisions seem overall helpful for designing skills learning trajectories.

Programme teams reported on their intentions to evaluate skills learning trajectories by questioning users (staff and students) of the learning trajectory (e.g., Ashby et al., 2018; Haas et al., 2012). In reality, almost no cases actually evaluated the trajectories. This may not be surprising, as most of them were still in the process of implementing the learning trajectories, or had just finished. Evaluations are important to determine whether learning trajectories are beneficial to students' skills development and under what conditions. It may take a long time before effect studies can be done. Moreover, the current study shows that there is no one-size fits all regarding design choices for skills learning trajectories. Therefore, gaining insights into the design choices programmes make within their own context and for what reasons, is an important step to take before being able to study their effectiveness and to compare the different setups (e.g., Whillier et al., 2019; Barrett et al., 2003; O'Neill et al., 2014). Moreover, creating this overview of design choices allows other educational programmes that intend to design skills learning trajectories to make more informed decisions.

As shown by the two presented cases, multiple pathways could lead to a generic skills learning trajectory, which could appear in different shapes even if the initial reasons to start were comparable (see Whillier et al., 2019; Wijngaards-de Meij & Merx, 2018). It is plausible that most educational programmes or institutes in the 13 case studies from this review started from scratch in designing and implementing skills learning trajectories, as none of the case studies included in this study reported on using literature about previously designed skills learning trajectories. This might explain why they all made different choices in the design and implementation phases, which makes sense given the dependence on the particular context, vision, and goal (e.g., Whillier et al., 2019; Barrett et al., 2003; O'Neill et al., 2014). Nevertheless, this study helped to create an overview of the development processes educational programmes may be engaged in, and the choices they can make in the design and implementation of the trajectory. This shows again how important studies on design choices are.

Finally, this study examined what helping and hindering factors could be identified that may (not) help the design and implementation of the skills

learning trajectories. Four domains emerged from the literature: Programme, staff, students, and tools and artefacts. Especially making sure that staff is sufficiently engaged but their workload is not too high seems important for successful implementation of skills learning trajectories. This study provides an overview of the factors that educational programmes should take into account to improve the chance of successfully implementing skills learning trajectories. The literature, however, did not provide much insight in how programmes dealt with factors that hindered designing or implementing these learning trajectories, and how they tried to overcome such factors. Future, more practice-oriented studies in which stakeholders are interviewed on the process of designing and implementing skills learning trajectories may deal with this question.

Limitations and future studies

This review study included 13 selected scientific publications. The fact that only a limited number of scientific articles on skills learning trajectories in higher education was found, might have had a number of reasons. One possible reason is that skills learning trajectories are relatively new, and their design and development process have not been systematically documented yet (see also Biemans et al., 2024). A second possible reason is that universities might not describe the design and development process of skills learning trajectories in scientific publications, but rather in the 'grey' literature such as internal university documents. This seems to be a plausible reason, since designing and implementing skills learning trajectories often originates from bottom-up initiatives, instead of education reforms that are prompted by evidence-based literature. In that sense, daily educational innovation practices may be ahead of scientific reports about these practices. It may thus be likely that we were not able to capture all initiatives on skills learning trajectories in higher education. Future studies may consider to also include non-scientific articles or documents that describe the design choices (regarding reason to start, goals, (development) process, product, evaluation) of skills learning trajectories, as these may provide relevant sources of information. At the same time, educators should be encouraged to describe these design decisions of designing skills learning trajectories in scientific papers, to get more insight in how they try to achieve constructive alignment (Kamovich & Foss, 2017).

Third, in the present study, the lack of clear and consistent terminology in the selected articles was evident. Whereas some articles reported about learning trajectories, other manuscripts reported about learning lines or learning pathways. All these terms were included in the search to try to capture the variety in terminology. However, it is the question whether different terms are always used to refer to the same design choices of skills learning trajectories or to slightly different phenomena. This shows the need for consistent terminology concerning skills learning trajectories in future studies.

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Recommendations for educational practice

The scientific literature showed considerable variation in how learning trajectories for skills were designed and implemented in higher education. Nevertheless, several recommendations for educational practice can be formulated based on this study. To ensure constructive alignment (Biggs & Tang, 2015), educational programmes aiming to design and implement a skills learning trajectory should make the underlying reasons for starting this trajectory very explicit, as these reasons have consequences for the goals of the trajectory. In the development process of designing the trajectory, it is important to engage in curriculum visualisation, mapping, and sequencing, to get a clear overview of what the learning trajectory will look like and how course outcomes are connected to the overall learning outcomes of the trajectory. Educational programmes may use various ways to visualize the shape of the skills learning trajectory throughout the curriculum: By introducing it at the start of the programme (either with an introductory course or by mentioning it in the first weeks), by using building blocks of core courses, and/or by using courses at the end of the trajectory. Evaluation of the trajectory can best be done by including direct stakeholders (staff and students). Programmes should at all times be aware of the factors that influence the success of the trajectory, and should especially make sure that staff is engaged with the learning trajectory but that their workload does not increase too much. Keeping these recommendations in mind when designing and implementing skills learning trajectories may promote successful implementation of trajectories in all their possible shapes.

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PEDAGOGISCHE STUDIËN

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Samenvatting

Leerlijnen voor het ontwikkelen van generieke vaardigheden in het hoger onderwijs: een reviewstudie naar ontwerpkeuzes en bevorderende en belemmerende factoren

Studenten in het hoger onderwijs worden geacht verschillende generieke of vakoverstijgende vaardigheden te ontwikkelen. Om de ontwikkeling van dergelijke vaardigheden te stroomlijnen, worden doorlopende leerlijnen voor vaardigheden ontworpen en geïmplementeerd in opleidingen. Het doel van deze reviewstudie was om inzicht te krijgen in ontwerpkeuzes van dergelijke doorlopende leerlijnen voor vaardigheden (reden om te starten, doelen, proces, product, evaluatie) en in bevorderende en belemmerende factoren bij de ontwikkeling en implementatie van deze leerlijnen. Uit de analyse van 13 artikelen bleek dat vaak gebruik gemaakt wordt van visualisatietechnieken, 'curriculum mapping', en 'curriculum sequencing' voor het weergeven van het curriculum van de opleiding met de leerlijnen voor generieke vaardigheden. Hoewel verschillende opleidingen vaak vergelijkbare redenen geven om een leerlijn voor vaardigheden te ontwikkelen en er vergelijkbare doelen mee nastreven, blijkt de vormgeving van leerlijnen te verschillen tussen opleidingen. Verscheidene factoren blijken een succesvolle implementatie van leerlijnen te bevorderen of te belemmeren, maar vooral de betrokkenheid van het onderwijspersoneel en hun werkdruk spelen een belangrijke rol. De resultaten van deze studie worden geïllustreerd door middel van concrete cases van leerlijnen voor het ontwikkelen van generieke vaardigheden. Bovendien worden de wetenschappelijke en praktische implicaties van het onderzoek voor het ontwikkelen van dergelijke leerlijnen bediscussieerd.

Kernwoorden Doorlopende leerlijnen, generieke vaardigheden, hoger onderwijs, reviewstudie, vaardigheidsonderwijs

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Learning trajectories for developing generic skills in higher education: A review study on design choices and helping and hindering factors

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